

CLAIMS

What is claimed is:

1. A variable gain amplifier, comprising:
 - an input stage that receives an input signal and converts the input signal into a corresponding intermediate signal;
 - an output stage that provides an output signal based on the intermediate signal and a gain control signal; and
 - a feedback stage that provides a feedback signal to the input stage as a function of the gain control signal, the intermediate signal varying as a function of the input signal and the feedback signal.
2. The amplifier of claim 1, the input stage further comprising a transconductance amplifier that converts the input signal into a corresponding current signal based on the feedback signal and the input signal, the corresponding current signal defining the intermediate signal.
3. The amplifier of claim 2, the feedback stage comprising circuitry to implement current mode feedback for the input stage according to the gain control signal.
4. The amplifier of claim 1, the output stage further comprising a current steering system operative to direct a first part of the intermediate signal to the output signal and a second part of the intermediate signal to the feedback stage, which provides the feedback signal based on the second part of the intermediate signal.
5. The amplifier of claim 4, the current steering system providing the first and second parts of the intermediate signal to each of the output signal and the feedback stage in proportions functionally related to the gain control signal.

6. The amplifier of claim 1, further comprising an analog gain control system coupled to the output stage, the gain control system being operative to receive an external gain control signal and to convert the external gain control signal to the gain control signal in an analog domain.

7. The amplifier of claim 6, the analog gain control system providing the gain control signal to allow for gain control of the amplifier that is substantially linear in dB with respect to the external gain control signal.

8. The amplifier of claim 7, the analog gain control system further comprising bipolar transistors arranged to generate the gain control signal in the analog domain so as to enable gain control of the amplifier that is linear in dB with respect to the external gain control signal.

9. The amplifier of claim 7, the analog gain control system being configured to generate the gain control signal so that gain control of the amplifier is proportional to $\exp(-V_{ex}/V_t)$, where V_{ex} is the external gain control signal and V_t is a constant thermal voltage of bipolar transistors that form part of the analog gain control system.

10. A variable gain amplifier, comprising:

- an input stage that receives an input signal and provides a corresponding intermediate signal;
- an output stage that provides an output signal based on the intermediate signal and an internal gain control signal;
- an analog gain control system operative to receive an external gain control signal and to convert the external gain control signal to the internal gain control signal; and
- a feedback stage that provides a feedback signal to the first amplifier stage as a function of the internal gain control signal.

11. The amplifier of claim 10, the analog gain control system providing the internal gain control signal so as to enable gain control of the amplifier that is substantially linear in dB with respect to the external gain control signal.

12. The amplifier of claim 11, the gain control system further comprising transistors arranged to generate the internal gain control signal functionally related to the external gain control signal, such that the internal gain control signal allows for gain control of the amplifier that is substantially linear in dB with respect to the external gain control signal.

13. The amplifier of claim 11, the gain control system further comprising at least one bipolar transistor that enables the gain control system to generate the internal gain control signal so that the gain control of the amplifier is proportional to $\exp(-V_{ex}/V_t)$, where V_{ex} is the external gain control signal and V_t is a constant thermal voltage of the at least one bipolar transistor.

14. The amplifier of claim 10, the input stage further comprising a transconductance amplifier operative to convert the input signal into a corresponding current signal based on the feedback signal and the input signal.

15. The amplifier of claim 14, the feedback stage providing current mode feedback to the transconductance amplifier according to the internal gain control signal.

16. The amplifier of claim 14, the output stage further comprising a current steering system operative to direct a first part of the corresponding current signal to the output signal and a second part of the intermediate signal to the feedback stage based on the internal gain control signal, the feedback stage providing the feedback signal based on the second part of the intermediate signal.

17. The amplifier of claim 16, the current steering system providing the intermediate signal to each of the output signal and the feedback stage in proportions functionally related to the gain control signal.

18. A variable gain amplifier, comprising:
means for converting a received input signal into an intermediate signal;
means for steering one part of the input signal to an output and another
part of the input signal to means for generating a feedback signal based on a gain control
signal; and

the means for generating a feedback signal providing the feedback signal
to the means for converting based on the another part of the input signal.

19. The amplifier of claim 19, further comprising means for converting an
external gain control signal to the gain control signal that is provided to the means for
steering so as to implement a gain control of the amplifier that is substantially linear in
dB.

20. A variable gain amplifier, comprising:
an input stage that receives an input signal and a feedback signal and
provides an intermediate signal as a function of the input signal and the feedback signal;
an output stage that provides an output signal based on the intermediate
signal and a gain control signal; and

a feedback stage that provides the feedback signal to the input stage as a
function of the gain control signal so as to maintain a substantially constant maximum
amplitude for a difference between the input signal and the feedback signal in the input
stage, thereby providing substantially constant output linearity over a range of amplitudes
for the input signal.

21. The amplifier of claim 20, the output stage further comprising a current
steering system operative to direct a first part of the intermediate signal to the output
signal and a second part of the intermediate signal to the feedback stage, which provides
the feedback signal based on the second part of the intermediate signal.

22. The amplifier of claim 20, further comprising an analog gain control system coupled to the output stage, the gain control system being operative to receive an external gain control signal and to convert the external gain control signal to the gain control signal in an analog domain.

23. The amplifier of claim 21, the analog gain control system providing the gain control signal to allow for gain control of the amplifier that is substantially linear in dB with respect to the external gain control signal.

24. A method for providing variable gain amplification in a variable gain amplifier, comprising:

- receiving an input signal at an input stage;
- converting the input signal into an intermediate signal;
- directing part of the intermediate signal to an output of the variable gain amplifier based on a gain control signal;
- directing another part of the intermediate signal to feedback circuitry based on the gain control signal; and
- providing a feedback signal to the input stage based on the another part of the signal directed to the feedback circuitry.

25. The method of claim 24 further comprising converting an external gain control signal to the gain control signal in an analog domain so that gain control provided by the variable gain amplifier is substantially linear in dB.

26. The method of claim 25, the conversion of the external gain control signal further comprising, in the analog domain, converting the external gain control signal into an internal gain control signal so that the gain control of the amplifier is proportional to an exponential of the external gain control signal.